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A REVIEW OF THE COBITIDÆ, OR LOACHES, OF THE RIVERS OF JAPAN.

BY

DAVID STARR JORDAN

AND

HENRY W. FOWLER,

Of the Leland Stanford Junior University.

From the Proceedings of the United States National Museum, Vol. XXVI, pages 765-774.

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A REVIEW OF THE COBITIDÆ, OR LOACHES, OF THE RIVERS OF JAPAN.

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In the present paper is given an account of the species of *Cobitidæ*, small fishes known in English as loach, in Japanese as Dojo, recorded from the streams and lakes of Japan. It is based on the collections made by Messrs. Jordan and Snyder in 1900, preserved in the U. S. National Museum and in the collections of Leland Stanford Junior University. The plates are by Mrs. Chloe Lesley Starks.

Family COBITIDÆ.

Body more or less elongate, oblong, compressed, or cylindrical, but never depressed. Head depressed or compressed; snout more or less fleshy, blunt, inferior; the lips fleshy and furnished with from 6 to 12 barbels. Pharyngeal teeth few, in one row and in moderate number; no pseudobranchiæ. Scales small, rudimentary, or entirely absent; cycloid, when present, usually immersed in mucous skin, and rarely present on the head. Lateral line single; air vessel entirely or partially inclosed in bone. Vertical fins spineless, the dorsal rays varying from 8 to 30, the anal with about 7 or 8, and the ventrals sometimes absent. Small fishes confined to the rivers of the Old World in Europe and Asia. They are used as food.

a. No erectile spines below the eye.
  b. Barbels 10 or 12; 4 about the mandible; dorsal, short; caudal rounded; lateral line medium ..... *Misgurnus*, 1.
  bb. Barbels 6 or 8; none about the mandible.
    c. Barbels 8, a pair of nasal barbels being present; dorsal short; caudal rounded; lateral line obsolete ..... *Elxis*, 2.
    cc. Barbels 6, no nasal barbels being present; dorsal fin short; caudal fin truncate; lateral line median ..... *Orthrias*, 3.
aa. An erectile spine below the eye.
    d. Caudal fin rounded; lateral line incomplete; dorsal short ..... *Cobitis*, 4.
    dd. Caudal fin deeply forked.
      e. Barbels 6; body rather robust; lateral line complete; dorsal rather long. *Hymenophysa*, 5.

1. MISGURNUS Lacépède.

Misgurnus LACÉPÈDE, Hist. Nat. Poiss., V, 1803, p. 16 (*fossilis*).

Body elongate, compressed. Head triangular, elongate, compressed; snout projecting; mouth inferior, with fleshy lips; barbels 10 or 12, of which 4 are mandibular; eye small. Gill-openings lateral; lateral line complete. No spine below the eye. Body with small scales, except on the head, which is naked. Origin of the dorsal about in the middle of the length of the fish, over the ventrals; anal entirely behind dorsal; pectorals more or less equal to the head; caudal nearly equal to head, and rounded. Air-bladder in a bony capsule.

(*misgurn*, a vernacular name used by Willughby for *Misgurnus fossilis*.)

a. Barbels 12, 4 belonging to the mandible ..... *polynemus*, 1.
aa. Barbels 10, 4 belonging to the mandible ..... *anguillicaudatus*, 2.

1. MISGURNUS POLYNEMUS (Bleeker).

Cobitichthys polynema BLEEKER, Act. Soc. Sci. Indo-Neerl, VIII, 1860, p. 90, pl. II, fig. 3; (Jeddo=Tokyo).

Misgurnus polynema GÜNTHER, Cat. Fish. Brit. Mus., VII, 1868, p. 346 (after Bleeker).—JORDAN and SNYDER, Annot. Zool. Japan, III, 1901, p. 45.

D. 10; A. 7; V. 6. Barbels 12; 4 belonging to the mandible. Scales conspicuous. Origin of the dorsal midway between the root of the caudal and the gill-opening; pectoral fin shorter than the head. Color nearly uniform brownish, tail and caudal fin with scattered blackish spots. Jeddo. (Günther.)

Not seen by us.

(πολύς, many; νῆμα, thread.)

2. MISGURNUS ANGUILLICAUDATUS (Cantor).

DOJO.

Cobitis anguillicaudata CANTOR, Ann. Mag. Nat. Hist., IX, 1842, p. 485.—RICHARDSON, Ichth. China, 1846, p. 300; Canton.

Misgurnus anguillicaudatus GÜNTHER, Cat. Fish, VII, 1868, p. 345; China, Chusan, Japan, Formosa.—JORDAN and SNYDER, Check List, 1901, p. 45.

Cobitis bifurcata MCCLELLAND, Calcutta Jour. Nat. Hist., IV, 1844, p. 400, pl. XXIII, fig. 1; India.

Cobitis pectoralis MCCLELLAND, Calcutta Jour. Nat. Hist., IV, 1844, p. 400, pl. XXIII, fig. 3; India. (Specimens with long pectorals.)

Cobitis rubripinnis SCHLEGEL, Fauna Japonica, Poiss., 1846, p. 220, pl. CIII, fig. 1; near Nagasaki.

Cobitis maculata SCHLEGEL, Fauna Japonica, Poiss., 1846, p. 221, pl. CIII, fig. 2; near Nagasaki.

Cobitis micropus CUVIER and VALENCIENNES, Hist. Nat. Poiss., XVIII, 1846, p. 29; China.

Cobitis psammismus RICHARDSON, Ichthy. China, 1846, p. 300; Canton.

Cobitis decemcirrosus BASILEWSKY, Mem. Soc. Nat. Mosc., 1855, p. 239; near Peking.

Cobitichthys enalios BLEEKER, Act. Soc. Sci. Indo-Neerl., VIII, 1860, Japan, VI, p. 88, pl. II, fig. 4; Japan; specimens with long pectorals.

Cobitichthys dichachrous BLEEKER, Act. Soc. Sci. Indo-Neerl., VIII, 1860, Japan; IV, p. 89, pl. II, fig. 2; Yeddo (Tokyo); specimens bicolor, the two shades sharply defined.

Misgurnus dichachrous GÜNTHER, Cat. Fish, VII, 1868, p. 346; Yeddo; same specimens.

Head 6 in length; depth $6\frac{3}{5}$; D. 9; A. 8; P. I. 9; V. 6; width of head 2 in its length; eye 3 in snout, $1\frac{2}{3}$ in interorbital space; snout $2\frac{1}{2}$ in head; pectoral $1\frac{3}{5}$; ventrals $2\frac{1}{2}$; scales about 150.

Body elongate, greatly compressed. Head small, triangular, and compressed; snout long, obtuse, rounded and produced; eyes small, anterior and superior; mouth inferior, with thick fleshy lips; barbels 10, of which 4 are on the lower jaw; nostrils close together and in front of the eye, the first pair in a short tube; interorbital space slightly convex, much less than the length of the snout; cheeks not swollen. Gill-openings lateral, joined below in front of the base of the pectoral.

Head naked, the trunk covered with small cycloid scales.

Origin of the dorsal about midway in the length of the body, including caudal, and directly over the ventrals, the fin short; anal entirely behind the dorsal, and nearer the origin of the ventrals than the base of the caudal; caudal oblong, broad, rounded, and about equal to the head; pectorals short and low; ventrals short. Caudal peduncle long and deep, its depth about three-fourths the head. Lateral line medium along the sides to the base of caudal.

Color in alcohol dark gray-brown, above spotted and marbled with darker, the spots smaller on the tail, and those on the caudal and dorsal fins very small; sides of the body with many narrow more or less even longitudinal blackish stripes; lower parts of the body together with the ventrals and anal, pale; pectoral pale, except some dusky on the upper part of the longer rays.

Length $7\frac{3}{8}$ inches.

This description from a specimen from the Yodo River in Osaka.

Of this species, which is very abundant in all the rivers and lakes of Japan we have many examples. They are from Junsai Lake in Aomori, Hakodate, from the Sapporo Museum, Tsuchiura, Niigata, Aomori, Sendai, the Yodo River in Osaka, the Iwai River at Ichinoseki, and at Morioka, Misaki, Tokyo, Nagasaki, and Formosa.

In this large series we are unable to distinguish more than one species, subject to great variations. In some examples the lower surface of the body is mottled or spotted like the back. We also notice many examples, as Dr. Günther has observed, with deep bodies and adipose layers along the rudimentary caudal rays, perhaps better fed than usual.

(*anguilla*, eel; *caudatus*, tailed.)

2. ELXIS Jordan and Fowler.

Elxis JORDAN and FOWLER, new genus (*nikkonis*).

Body moderately elongate, compressed; head elongate, sometimes depressed; eyes small; snout produced and rounded; mouth inferior, with fleshy lips and four rostral, two maxillary, and two nasal barbels, none on the mandible; scales large and cycloid; lateral line incomplete; caudal rounded, sometimes longer than the head; pectorals variable; gill openings lateral; color variegated with blotches and mottlings, and usually a dark spot at base of caudal. Small loaches, of the waters of Japan.

(ἕλξις, a trailing.)

3. ELXIS NIKKONIS Jordan and Fowler, new species.

Head $4\frac{1}{2}$ in length; depth $6\frac{1}{2}$; D. 8; A. 7; P. 12; V. 6; scales about 56; width of head $1\frac{1}{2}$ in its length; snout 3 in head; interorbital space $2\frac{1}{2}$; pectoral $1\frac{1}{2}$; ventral $1\frac{2}{3}$; eye 2 in interorbital space.

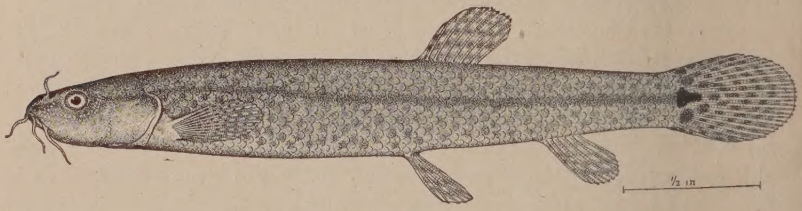

FIG. 1.—ELXIS NIKKONIS.

Body elongate and rather slender, the tail compressed. Head broad, depressed, and elongate; snout broad, depressed, rounded, and produced; eyes small, anterior, lateral; mouth rather broad, inferior and with fleshy lips; barbels 8, of which there is a nasal pair, and the maxillary pair is the longest, though there are no mandibulars; interorbital space very broad and depressed like the top of the head, flattened; nostrils large, in front of the eyes above. Gill openings rather large, lateral and joined below the base of the pectoral in front.

Scales on the body rather large and cycloid, none on the head.

Origin of the dorsal nearer the tip of the caudal than the tip of the snout, about equal to the height of the body, and its length, when depressed, about three-fourths the length of the head; anal entirely behind dorsal and reaching two-thirds of the space between its origin and the base of the caudal; caudal less than head, and rounded; pectorals small, low, reaching about two-fifths in the space between their origins and those of the ventrals; ventrals a little before the origin of the dorsal, nearer the gill opening than the base of the caudal, and reaching more than half the distance between their own origins and that of the anal. Caudal peduncle long, equal to head without snout,

and its greatest depth $2\frac{1}{2}$ in the length of the head. Lateral line absent.

Color in alcohol brown, dark on the back, and top of the head, with small blotches and mottlings of deeper; along the sides a rather irregularly defined longitudinal dark band, ending in a blackish spot at the base of the middle caudal rays; all the fins more or less spotted with dark brown, deepest, best defined, and largest on the dorsal and caudal; lower surface of the body pale or whitish.

Length $2\frac{13}{16}$ inches.

Type No. 7848, Ichthyological Collections Leland Stanford Junior University Museum. Locality, Chitose, in Iburi, Hokkaido.

Of this species we have a number of examples from the province of Shimotsuke, near Nikko, and from Chitose, in Iburi, Hokkaido, the latter received from the Sapporo Museum.

3. ORTHRIAS Jordan and Fowler.

Orthrias JORDAN and FOWLER, new genus (*oreas*).

Allied to *Nemacheilus* Van Hasselt.

Body elongate and compressed. Head sometimes depressed, and with the dorsal profile nearly horizontal; no spine below eye; mouth small, inferior, and with fleshy lips; barbels 6, none on the mandible. Dorsal fin short, and situated over the ventrals. Ventral rays 8. Air bladder more or less inclosed in a bony capsule. Caudal rounded or truncate, not forked. Lateral line complete. Fresh waters of Eastern Asia, the species apparently numerous.

This genus is related to *Nemacheilus*, but the original type of that group (*N. fasciatus*) has about 13 dorsal rays and the caudal forked. The Japanese species with a short dorsal and a truncate caudal is therefore made the type of a distinct genus, *Orthrias*, to which numerous Chinese and other Asiatic species apparently also belong.

(ὀρθριός, of the dawn; hence Japanese.)

4. ORTHRIAS OREAS Jordan and Fowler, new species.

Head $4\frac{3}{4}$ in length; depth 9; D. 10; A. 8; P. 14; V. 8; width of head $1\frac{4}{5}$ in its length; snout $2\frac{1}{2}$ in head; interorbital space 4; eye 2 in snout; pectoral $1\frac{1}{4}$ in head; ventral $1\frac{2}{5}$.

Body moderately elongate and compressed, the tail compressed. Head elongate, broad, depressed; snout long, blunt, obtusely rounded and produced; eyes small, a little anterior and superior; mouth small, inferior and with thick fleshy lips; barbels 6, none on the mandible, and the maxillary pair the longest; nostrils close together and in front of the eye, and the anterior in a small tube; interorbital space like the top of the head, broad and slightly convex. Gill-openings lateral, and the membranes joined below the base of the pectoral in front.

Scales minute, and embedded in the skin; head apparently naked.

Origin of the dorsal midway between the tip of the snout and the base of the caudal; the height of the dorsal is greater than the depth of the body, and when depressed its length is only a little less than that of the head; anal entirely behind the dorsal, and reaching more than half the space between its own origin and the base of the caudal; caudal about equal to the depressed dorsal, truncate, its margin straight, and with sharp corners; pectorals rather long, three-fourths the length of the head, and halfway in the space between their own origins and those of the ventrals; ventrals below and just a trifle behind the origin of the dorsal, and reaching more than halfway in the space between their own origins and that of the anal. Caudal peduncle long, compressed, its length about equal to the pectoral and its least depth about $2\frac{1}{2}$ in the head. Lateral line continuous, median along the sides.

Color in alcohol pale brown above, with about 15 large blotches of deep brown; a dark streak from eye to tip of snout; head finely mottled with dark brown above; dorsal and caudal whitish, with broad,

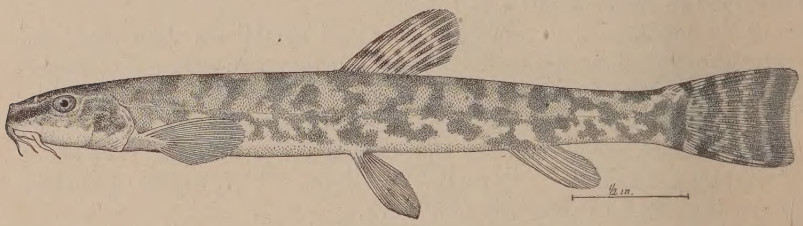

FIG. 2.—ORTHRIAS OREAS.

deep, brownish cross bars; pectorals, anal and ventrals whitish, with dusky blotches, indistinct on the latter fins; lower surface on the head and trunk whitish.

Length $3\frac{7}{16}$ inches.

Type, a specimen in the museum at Sapparo, kindly loaned to us by Mr. S. Nozawa. Locality, Chitose, in Iburi, a province of Hokkaido. This specimen, received from the Sapporo Museum, is the only example of the species we have seen.

(ὄρειας, of the hills.)

4. COBITIS (Artedi) Linnæus.

Cobitis ARTEDI, Genera, 1738 (nonbinomial).
Cobitis LINNÆUS, Syst. Nat., 10th ed., 1758, p. 303 (*tænia*).
Acanthopsis AGASSIZ, Mém. Soc. Sci. Nat. Neuchâtel, I, p. 36 (*tænia*, not of Van Hasselt, 1823).

Body elongate, more or less compressed, and the back not arched. Head elongate, compressed; eyes small; snout produced, blunt and rounded; mouth small, inferior, and with six barbels about the upper

jaw; below the eye, an erectile bifid spine. Dorsal fin about over the ventrals; anal behind dorsal; caudal rounded or truncate; pectorals less than the head; ventrals below dorsal. Air-bladder inclosed in a bony capsule. Lateral line incomplete. Small fresh-water fishes of Europe and Asia. Probably all the species described, will be referred to the widely distributed and variable form described below.

(*cobitis*, a loach.)

5. COBITIS TÆNIA Linnæus.

TAKANOHADOJO (HAWK-WING LOACH), SHIMADOJO (STRIPED LOACH).

Cobitis tænia LINNÆUS, Syst. Nat., 10th ed., 1758, p. 303; Europe.—CUVIER and VALENCIENNES, Hist. Poiss., XVIII, 1846, p. 58.—GÜNTHER, Cat. Fish., VII, 1868, p. 362; Holland, Bavaria, Sweden, and of authors generally.

Cobitis tænia japonica SCHLEGEL, Fauna Japonica, Poiss., p. 222, pl. CIII, fig. 3, 1846; near Nagasaki (not *Cobitis japonica* Houttuyn).

Cobitis caspia EICHWALD, Bull. Soc. Nat. Mosc., 1838, p. 133; near Caspian Sea.

Cobitis elongata HECKEL and KNER, Süssenwasserfische Oester., 1858, pp. 164, 305; Austria.

Cobitis larvata DE FILIPPI, Mem. Accad. Torin., XIX, p. 71; Italy.

Cobitis sinensis SAUVAGE and DE THIERSANT, Ann. Sci. Nat., (6) 1875, I, p. 8; Setchuan, China.—FOWLER, Proc. Acad. Nat. Sci. Phila., 1899, p. 182.

Cobitis biwæ JORDAN and SNYDER, Proc. U. S. Nat. Mus., 1901, p. 748; Lake Biwa, substitute for *Cobitis japonica*, preoccupied.

Head $4\frac{3}{4}$ in length; depth $5\frac{1}{3}$; D. 8; A. 7; P. 10; V. 8; width of head, a little over 2 in its length; snout $2\frac{1}{4}$ in head; pectoral $1\frac{1}{2}$; ventrals $1\frac{2}{5}$; eye $5\frac{2}{3}$; interorbital space $5\frac{2}{3}$.

Body elongate, compressed. Head elongate, much compressed, and with the upper profile convex; snout long, produced, and bluntly rounded; eyes small, superior, lateral, and nearer the tip of the snout than the gill-opening; mouth small, inferior, and with fleshy lips, the lower divided and with two lobes; barbels 8, two of which are mandibulars; nostrils nearer the eye than the tip of the snout, close together, and the anterior pair in a short tube; interorbital space narrow, about equal to the eye and convex. Gill-openings large, lateral, and the gill-membrane joined below the base of the pectoral in front.

Scales very small on the trunk, none on the head.

Origin of the dorsal nearer the base of the caudal than the tip of the snout and a little in front of the ventrals; length of dorsal when depressed a little less than the length of the head and the height of the fin much less than the greatest depth of the body; anal entirely behind dorsal and reaching two-thirds the space between its origin and the base of caudal; caudal equal to depressed dorsal, and rounded; pectoral $1\frac{2}{3}$ in head, and $2\frac{1}{4}$ in the space between its own origin and that of the ventral; ventrals 2 in the space between their own origins and that of the anal. Caudal peduncle compressed, its length equal to the pectoral, and its depth a little less than 2 in the head. Lateral line short, only running a little beyond the middle of the pectoral.

Color in alcohol pale brownish, dark above, and the sides with two rows of dark blotches, those in the lower row large, and between the two rows a narrow paler marbled brown streak; 6 blotches of dark brown between occiput and origin of dorsal, and 7 more between the latter and the base of caudal; base of caudal above with a jet-black spot; dorsal and caudal barred broadly with blackish brown; head marbled and spotted with brown above, and a blackish streak from eye to snout; lower surface of the body, pectorals, ventrals, and anal, pale or whitish.

Length $3\frac{13}{16}$ inches.

This description from an example from Kawatana, on Omura Bay.

Fresh waters of Japan; our very numerous series from Aomori, Kitakami River, lake near Sendai (collection Awano), Niigata in Echigo (collection Eitaro Iijima), Tamagawa in Tachikawa, Kinu River, in Utsunomiya, Iwai River in Ichinoseki, Tokyo, Tsuruga, Nagoya in Owari (collection K. Otaki), Yodo River at Osaka, Chikugo River at Kurume, Kawatana, and Lake Biwa.

In this series great variation occurs. The examples from Lake Biwa are very much more elongate and have the brown blotches on the sides merged into a continuous longitudinal band, and the space between it and the superior dorsal row of spots, which is also more or less continuous, light and plain colored, like the lower surface of the body. The colors are altogether more distinct and sharply defined, and the dorsal and caudal are with only one or two blackish bars. This form has been described from near Nagasaki under the name of "*Cobitis tænia japonica*" by Schlegel. As the name *japonica* is preoccupied in *Cobitis*, Jordan and Snyder have substituted for it the name of *Cobitis biwæ*. But there seems to be no permanent value in these differences in color and form. Examples from Kawatana and the Chikugo River at Kurume, collected together in both localities, contain both this striped form and those with the lateral bands broken up into spots.

We can not find any difference between the Japanese species and the Loach of Europe, and hence retain for it the ancient name of *Cobitis tænia*. Should the Asiatic species prove distinct, the name *Cobitis sinensis* may be retained for it.

(*ταινία*, ribbon.)

5. HYMENOPHYSA McClelland.

Hymenophysa McClelland, Indian Cyprinidæ, 1838, p. 443 (*hymenophysa*).
Syncrossus Blyth, Journ. Asiat. Soc. Bengal, 1860, p. 166 (*berdmorei*).

Body short, deep, and compressed. Head elongate, compressed, and pointed, the snout long, pointed and its tip bluntly rounded; eyes small; mouth inferior and with fleshy lips; barbels 6, the maxillary pair long, and the others close together at the tip of the snout;

no mental barbels; a strong bifid spine below the eye in front. Gill-openings lateral. Scales very small. Dorsal inserted in advance of the origin of the ventral; caudal deeply forked. Air-vessel consisting of two divisions, an anterior inclosed in a partly osseus capsule and a posterior which is free in the abdominal cavity.

This genus differs from *Botia* (=*Schistura*=*Diacantha*) in the presence of but six barbels instead of eight.

(ὑμήν, membrane; φυδός, swollen.)

6. HYMENOPHYSA CURTA (Schlegel).

AYAMADOKI; AYABATA.

Corbitis curta SCHLEGEL, Fauna Japonica, Poiss., 1846, p. 223, pl. CXII, fig. 4; near Nagasaki.

Botia curta GÜNTHER, Cat. Fish., VII, 1868, p. 368 (after Schlegel).

Head 4 in length; depth $4\frac{3}{4}$; D. 12; A. 9; P. 14; V. 8; scales 130; width of head $2\frac{1}{2}$ in its length; snout $2\frac{2}{3}$ in the head; pectoral $1\frac{2}{3}$; ventral $1\frac{3}{4}$; eyes $2\frac{1}{2}$ in snout; $1\frac{1}{3}$ in interobital space.

Body oblong, rather deep and compressed. Head oblong, compressed and pointed in front; snout long, pointed, and compressed, the tip bluntly rounded and slightly projecting beyond the mouth; eyes moderate, anterior, superior and with the eyelid freely circular; mouth small, inferior, and with fleshy lips; barbels 6, the maxillary pair reaching the eyes, and the remaining 4 are close together at the tip of the snout; nostrils close together, a little nearer the eye than the tip of the snout, and the anterior pair in a short tube; interorbital space convex. Gill-openings large, lateral.

Body and sides of the head covered with very small cycloid scales.

Origin of the dorsal about midway between the tip of snout and base of caudal, its height about equal to the length of the pectoral; anal entirely behind dorsal and reaching about two-thirds in the space between its own origin and the base of the caudal; caudal nearly equal to the length of the head, deeply forked and the lobes pointed; pectorals narrow, lobate, nearly two-thirds the length of the head, and equal to about half the distance between their own origins and those of the ventrals; ventrals behind the origin of the dorsal, and their tips not reaching as far as the tip of the depressed dorsal, or about two-thirds the space between their own origins and that of the anal. Caudal peduncle very deep, compressed, its length about equal to the ventral and its depth a trifle more but not equal to the length of the pectoral. Lateral line straight along the sides to the base of the caudal.

Color in alcohol more or less uniform brown, the back slightly darker; anterior edge of dorsal blackish-brown, and the fin with an indistinctly defined broad brown cross-bar; anal with a brown cross-bar, and two on each caudal lobe.

Length, $5\frac{13}{16}$ inches.

Described from a specimen taken at Kibama, Japan, near Lake Biwa; our specimens all from Kibama, in Omi, presented by the Imperial University at Tokyo.

(*curtus*, short.)

SUMMARY.

Family Cobitidæ.

1. *Misgurnus* Lacépède.

1. *polynemus* (Bleeker).

2. *anguillicaudatus* (Cantor); Junsai Lake in Aomori, Hakodate, Tsuchiura, Niigata, Sendai, Yodo River at Osaki, Iwai River at Ichinoseki, Morioka, Misaki, Tokyo. Nagasaki, Formosa.

2. *Elxis* Jordan and Fowler.

3. *nikkonis* Jordan and Fowler; Shimotsuke, near Nikko, Chitose in Iburi.

3. *Orthrias* Jordan and Fowler.

4. *oreas* Jordan and Fowler; Chitose in Iburi.

4. *Cobitis* Linnæus.

5. *tænia* Linnæus; Aomori, Kitakami River at Sendai, Niigata, Nagoya, Yodo River, Lake Biwa, Chikugo River at Kurume.

5. *Hymenophysa* McClelland.

6. *curta* (Schlegel); Kibama in Omi.